Anjana Malinge Samarakoon

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EDUCATION INFORMATION

Ph.D. Physics (Condensed Matter), 2017
University of Virginia, Charlottesville, VA
Research Advisor: Dr. Seung-Hun Lee and Dr. Alan Tennant
Thesis Title: "Jamming in spin systems."

B.S. Physics, 2010
University of Colombo, Sri Lanka
Class Obtained: First Class Honors (GPA: 3.54)
Research Advisor: K.A.I.L. Wijewardena Gamalath
Thesis Title: "One Dimensional Modeling of Plasma Diode using Various Numerical Techniques."

EMPLOYMENT INFORMATION

Postdoctoral Research Associate 01/2021
Material Science Division, Argonne National Laboratory

Job Description:

- Investigate advanced machine-learning-based data analysis techniques on X-Ray/ Neutron scattering data. e.g. X-TEC
- Working primarily on Ruddlesden-Popper oxide materials. e.g. $La_4Ni_3O_{10}$ and $Pr_4Ni_3O_{10}$

Postdoctoral Research Associate 01/2018 to
Neutron Scattering Division, Oak Ridge National Laboratory 12/2020

Job Description:

- Developed machine learning assisted modeling approaches for neutron diffuse and inelastic scattering, which can do multi-experiment regression on 3D-4D data sets and locate potential solutions in high-dimensional parameter spaces.
- Worked primarily on frustrated magnetic systems such as $Dy_2Ti_2O_7$, $RuCl_3$ and $Ba_3ZnRu_2O_9$.
- Involved in neutron experiment planning, execution, and data analysis.

- Collaborated with different groups on multiple projects: $RuCl_3$, $Ba_3ZnRu_2O_9$, Na_2Co_2, LiGaCr4S8, NaxCoO2, and Mn3Si2Te6. I contributed to these projects on data analysis and modeling.

Student Research Associate 05/2015 to
Neutron Scattering Division, Oak Ridge National Laboratory 12/2017

Job Description:

- Primarily studied glassiness in geometrically frustrated magnets. Also, I engaged in spin ice and spin liquid projects.
- Performed neutron scattering experiments and used high-resolution spectroscopy methods such as backscattering and spin echo to distinguish different magnetic glasses.
- Performed bulk susceptibility experiments and developed a systematic method to distinguish different magnetic glasses using aging and memory effect measurements.
- Developed a generic parallelizable MATLAB program and its C++ counterpart to do Langevin dynamics for a given a microscopic model.
- High Performance computing and curated data sets.

Research Associate / Teaching Assistant 05/2013 to
Department of Physics, University of Virginia, VA, USA 05/2015

Job Description:

- Performed both neutron scattering and bulk experiments on highly frustrated magnets such as SCGO and Y2Mo2O7.
- Developed a MATLAB program to do semiclassical spinwave calculations using the Holstein-Primakoff transformation for a given magnetic structure.
- Involved in sample synthesis and single crystal growth of SCGO/BCGO compound.

Teaching Assistant 09/2010 to
Department of Physics, University of Colombo, Sri Lanka 05/2012

Job Description:

- Worked as instructor-in-charge for Junior (3rd) year physics special undergraduate students from 2011 to 2012.
- Worked as an instructor for both Freshman (1st) and Sophomore (2nd) year general physics laboratory from 2010 to 2011.

TECHNICAL SKILLS AND PROFICIENCIES

Programming Expertise in:
MALTAB (including Parallel Computing Toolbox, Symbolic Math Toolbox, MATLAB Coder); C++; Python; MPI; OpenMP; Maching Learning / Deep Learning modelling in MATLAB and Python (Keras, Tensor Flow).

Numerical Calculations:
Metropolis sampling, Langevin dynamics, and Wang-Landau sampling.
Quantum calculations on magnetic systems using ALPS package.

Neutron scattering experience:
Neutron time-of-flight, backscattering, and spin echo spectroscopies. Have permoformed experiments at the following spectrometers,

- BASIS, NSE, CNCS, ARCS, SEQUOIA, and CORELLI at SNS, ORNL.
- DCS, NSE, and HFBS at NCNR, NIST.

Structure and magnetic refinements using GSAS, Fulprof, and SARAh.

Other Experimental experience:
Bulk property measurement using Quantum Design PPMS, and MPMS.
Rigaku powder X-Ray diffractometers and a homemade four circle XRD.
State synthesis and single crystals growth (flux method).

RESEARCH INTERESTS

Combine semi-classical simulation approaches with machine learning techniques to explore emergent phases in high-dimensional parameter spaces and identify unusual magnetic phases. I use this technique to analyze neutron diffuse and inelastic scattering data to find optimal physical descriptions of real materials.

Combine semi-classical simulations with several quantum mechanical techniques like exact-diagonalization (ED) and density matrix renormalization group (DMRG) calculations, to study quantum mechanical problems such as quantum-fluctuation induced glassy phases and quantum spin-ices. Moreover, apply these techniques to exotic spin-liquids and out-of-equilibrium states.

I have developed user-friendly programs to calculate thermodynamic properties as well as magnetic structure factors for microscopic models.

HONORS AND AWARDS

The **2019** Neutron Scattering Division(NSD) Award in the category of **Postdoc of the Year**, by NSD, Oak Ridge National Laboratory.

Department Fellowship for the academic year 2015-16 by Department of Physics, University of Virginia.

Award winner in the Department of Physics poster competition 2016, University of Virginia on the topic of "Aging and memory effects in the spin jam states of densely populated frustrated magnets."

Award winner in the Department of Physics poster competition 2015, University of Virginia on the topic of "Unveiling the secrets of two topological spin glasses".

PUBLICATIONS

Published

Machine Learning for Magnetic Phase Diagrams and Inverse Scattering Problems. 2021
A. Tennant, & **Anjana M. Samarakoon**
Journal of Physics: Condensed Matter

Inelastic Neutron Scattering Study of Magnetic Exchange Pathways in MnS 2021
Judith K. Clark, Vincent Yannello, **Anjana M. Samarakoon**, Cyris Ross, Madeleine C. Uible, V. Ovidiu Garlea, and Michael Shatruk
The Journal of Physical Chemistry virtual special issue "Alexander Boldyrev Festschrift"

Witnessing entanglement in quantum magnets using neutron scattering. 2021
Scheie, A., Pontus Laurell, **A. M. Samarakoon**, B. Lake, S. E. Nagler, G. E. Granroth, S. Okamoto, G. Alvarez, and D. A. Tennant.
arXiv preprint arXiv:2102.08376

Static and dynamic magnetic properties of honeycomb lattice antiferromagnets $Na_2M_2TeO_6$, M = Co and Ni 2021
Anjana M. Samarakoon, et al.
arXiv preprint arXiv:2105.06549

Machine learning for neutron scattering at ORNL. 2020
Doucet, Mathieu, **Anjana M. Samarakoon**, Changwoo Do, William T. Heller, Richard Archibald, D. Alan Tennant, Thomas Proffen, and Garrett E. Granroth.
Machine Learning: Science and Technology 2, no. 2: 023001

Machine-learning-assisted insight into spin ice $Dy_2Ti_2O_7$. 2020
Anjana M. Samarakoon, Kipton Barros, Ying Wai Li, Markus Eisenbach, Qiang Zhang, Feng Ye, V. Sharma et al.
Nature communications 11 (1), 1-9.

Exotic Magnetic Field-Induced Spin-Superstructures in a Mixed Honeycomb-Triangular Lattice System. 2019
Garlea, V. Ovidiu, Liurukara D. Sanjeewa, Michael A. McGuire, Cristian D. Batista, **Anjana M. Samarakoon**, David Graf, Barry Winn, Feng Ye, Christina Hoffmann, and Joseph W. Kolis.
Physical Review X, 9(1), 011038.

Tomonaga–Luttinger liquid behavior and spinon confinement in $YbAlO_3$ 2019
Wu, L.S., Nikitin, S.E., Wang, Z., Zhu, W., Batista, C.D., Tsvelik, A.M., **Samarakoon, A.M.**, Tennant, D.A., Brando, M., Vasylechko, L. and Frontzek, M.
Nature communications 10 (1), 698

Classical and quantum spin dynamics of the honeycomb Γ model 2018
Samarakoon, A.M., Wachtel, G., Yamaji, Y., Tennant, D.A., Batista, C.D. and Kim, Y.B.
Physical Review B 98 (4), 045121

Comprehensive study of the dynamics of a classical Kitaev spin liquid 2017
Samarakoon, A.M., Banerjee, A., Zhang, S.S., Kamiya, Y., Nagler, S.E., Tennant, D.A., Lee, S.H. and Batista, C.D.
Physical Review B 96 (13), 134408

Scaling of Memories and Crossover in Glassy Magnets 2017
Samarakoon, A.M., Takahashi, M., Zhang, D., Yang, J., Katayama, N., Sinclair, R., Zhou, H.D., Diallo, S.O., Ehlers, G., Tennant, D.A. and Wakimoto, S.
Scientific Reports 7 (1), 12053

Aging, memory, and nonhierarchical energy landscape of spin jam 2016
Samarakoon, A., Sato, T.J., Chen, T., Chern, G.W., Yang, J., Klich, I., Sinclair, R., Zhou, H. and Lee, S.H.
Proceedings of the National Academy of Sciences 113 (42), 11806-11810

Glassy Behavior and Isolated Spin Dimers in a New Frustrated Magnet BaCr9pGa12−9pO19 2016
Yang, J., **Samarakoon, A.M.**, Hong, K.W., Copley, J.R., Huang, Q., Tennant, A., Sato, T.J. and Lee, S.H.,
Journal of the Physical Society of Japan 85 (9), 094712

Spin jam induced by quantum fluctuations in a frustrated magnet 2015

Yang, J., **Samarakoon, A.**, Dissanayake, S., Ueda, H., Klich, I., Iida, K., Pajerowski, D., Butch, N.P., Huang, Q., Copley, J.R. and Lee, S.H.
Proceedings of the National Academy of Sciences 112 (37), 11519-11523

In-Review

Field-Induced Phase Transition of the Spin Liquid State in Triangular Antiferromagnet YbMgGaO4
Steinhardt, W.M., Shi, Z., **Samarakoon, A.**, Dissanayake, S., Graf, D., Liu, Y., Zhu, W., Marjerrison, C., Batista, C.D. and Haravifard, S.,
arXiv preprint arXiv:1902.07825

Glass formation and magnetic monopole localization in a cooled spin liquid via SQUID noise measurements
Anjana M. Samarakoon, Alexander Kirste, Bastian Klemke, Peter Strehlow, Michael Meissner, S.A. Grigera, Ralf Feyerherm, Feng Ye, Qiang Zhang, Zhiling Dun, Haidong Zhou, T. Egami, Claudio Castelnovo, Ludovic Jaubert, Roderich Moessner, D. Alan Tennant

In-Preparation

High-dimensional modeling of a proximate Kitaev spin liquid.
Anjana M. Samarakoon, Pontus Laurell, Christian Balz, Arnab Banerjee, Satoshi Okamoto, D. Alan Tennant

Powder inelastic modeling on a Shastry-Sutherland lattice found on BaNd2ZnO5
Hao Zhang, **Anjana Samarakoon**, Gabriele Sala, Matthew B. Stone, Cristian D. Batista and Andrew Christianson

INVITED TALKS

August 2021	"Machine-Learning for Inverse Scattering problems on frustrated systems" at SHUG/CNMS User Meeting. (Virtual)
July 2020	"Application of machine learning in condensed matter physics" at ACNS 2020. (Virtual)
April 2020	"Application of machine learning to frustrated magnets." at APS March meeting, 2020. (Could not present due to the unexpected cancelation of the conference)
June 2019	"Machine Learning and High-Performance computing for analysis and experimental optimization" at Diffuse Scattering Workshop, Oak Ridge National Laboratory.

Jan. 2019	"Machine Learning assisted modeling" at Shull-Wollan Center, Oak Ridge National Laboratory
March 2018	"A further classification of glassy magnets: Spin Jam and Spin Glass" at APS March Meeting 2018.
Oct. 2017	"*Comprehensive study of the dynamics of a classical Kitaev spin liquid*" at the Department of Physics and Astronomy, University of Tennessee.
Feb. 2017	"*Dynamics of Kitaev-Heisenberg model on a honeycomb lattice in the classical limit*" at the Department of Physics, University of Virginia

CONTRIBUTED TALKS

October 2019	"Extract microscopic information of materials from Neutron Scattering data using a Machine Learning assisted approach" at International Collaboration on Advanced Sources (ICANS XXIII)
Aug. 2019	"Machine Learning and High-Performance computing for analysis and experimental optimization" at Annual Oak Ridge Postdoctoral Association Research Symposium
March 2019	"Full spin modeling and efficient mapping of the high dimensional Hamiltonian in Dy2Ti2O7" at APS March Meeting 2019
Feb. 2019	"Machine Learning Assisted Modeling on Neutron Scattering Experiments" at Quantum Materials Workshop 2019
June 2019	"Model extraction from Neutron Scattering Data using a Machine Learning Assisted Modeling" at SNS-HIFR User Group meeting 2019
Feb. 2018	"Quantum-Classical crossover and modeling dynamics of spin systems" at Diffuse Scattering interest group meeting
March 2017	"*Comprehensive study of the dynamics of a classical Kitaev Spin Liquid*" at APS March Meeting 2017
March 2016	"*Aging and memory effects in the spin jam states of densely populated frustrated magnets*" at APS March Meeting 2016

REFERENCES

Seunghun Lee
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Charlottesville, VA 22904
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I hereby certify that the above particulars are true and correct to the best of my knowledge and are submitted for your kind perusal.

Thanking you,
Sincerely,

Anjana M Samarakoon
Postdoctoral Research Associate
Argonne National Laboratory